Final Screening Level Ecological Risk Assessment
Technical Memorandum
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

CDM Federal Programs Corporation (CDM Smith) received Work Assignment (WA) No. 004-RICO-02WE under the Remedial Action Contract (RAC) 2 Program to perform a Remedial Investigation/Feasibility Study (RI/FS) for the United States Environmental Protection Agency (EPA), Region 2 at the Cidra Groundwater Contamination Site (the site) located in Cidra, Puerto Rico (Figure 1). The overall purpose of the work assignment is to evaluate the nature and extent of contamination at the site and to develop and evaluate remedial alternatives, as appropriate.

This Screening Level Ecological Risk Assessment Technical Memorandum (SLERA), as part of the RI/FS, provides a preliminary evaluation of ecological risks from contaminants to environments present within the study area. The objective of this SLERA is to evaluate the potential for risk to ecological receptors at the site. Conservative assumptions are used to identify exposure pathways and, where possible, quantify potential ecological risks. This SLERA is prepared in accordance with EPA guidance (EPA 1997; 1998).

Tables and figures are presented at the end of the text. In addition, Attachment A presents letters received from the Puerto Rico Department of Natural and Environmental Resources (PRDNER) and EPA regarding Puerto Rico and federally-listed threatened and endangered species at or in the vicinity of the site.

Problem Formulation

The problem formulation contains a description of the environmental setting, conceptual site model (CSM), assessment and measurement endpoints, and risk questions.

Site Location and History

The municipality of Cidra is located in the central-eastern section of Puerto Rico in the northern foothills of the Cordillera Central Mountain Range (Figure 1). The site consists of a volatile organic compound (VOC) contaminated groundwater plume within the boundaries of the Cidra Industrial Park. The aquifer of concern at the site is the Pre-Robles volcanic bedrock that underlies the area. Currently the site is comprised of the VOC plume area, which includes four closed Puerto Rico Aqueduct and Sewer Authority (PRASA) public supply wells and two industrial supply wells.

The Puerto Rico Department of Health (PRDOH) ordered four PRASA public supply wells (Cidra 3, Cidra 4, Cidra 6, and Cidra 8) to be closed due to tetrachloroethene (PCE) contamination; 1,1-dichloroethene (DCE) and trichloroethene (TCE) were also detected in these wells. At the time of the well closures, the source(s) of contamination in the wells were unknown, and several investigations were conducted to identify potential source areas.

In October 2000, EPA completed an evaluation of the site prior to listing in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). Once listed, several investigations were conducted by EPA's Region 2 Site Assessment Team, which primarily involved the collection of groundwater samples from closed municipal supply wells and from 20 other active and inactive wells in Cidra. Several VOCs, were detected in soils collected from the International Dry Cleaners (IDC) site, Ramallo/Cidra Convention Center (CCC) site, and the Tech Group de Puerto Rico, Inc. site. Analytical results also confirmed the presence 1,1-DCE in a soil sample from the Zenith Laboratories Caribe, Inc. site, which was later on referred to as IVAX, and an estimated concentration for 2-butanone in a sample from the Caribbean Manufacturing Co.

A more detailed discussion of site history is provided in the RI report (CDM Smith 2013).

Site Habitats and Biota

Study area habitats were identified based on an ecological reconnaissance performed for the site on November 3, 2009. The field effort focused on areas which exhibited, at a minimum, marginal habitat suitable for supporting populations or ecological communities that would be prone to exposure from chemicals present in groundwater discharge. These areas consisted of aquatic and riparian habitats associated with the Rio Arroyata.

The site is located within an ecological zone of Puerto Rico characterized by moist-lowland forest, and consists of the densely populated Cidra commercial district which includes stores, private residences, municipal buildings, and the town plaza. Another dominant land feature, a large cemetery, is also present. Topography and surface water drainage at the site is to the south/southwest toward the Rio Arroyata and an unnamed stream that drains the area surrounding the Cidra cemetery.

The portion of the Rio Arroyata included in the ecological reconnaissance can be characterized as a low/moderate gradient stream comprised of various riffle/run/pool sequences no more than three to five feet in width, with depth ranging from a few inches to over a foot in pooled reaches. Stream banks are relatively steep. Debris piles and eroded banks within bends suggest moderate to high flow during precipitation events. Substrate varies from coarse sand/fine gravel to coarse gravel and cobble within riffle and run areas; coarse sand comprises the majority of substrate found in deeper pools as these are associated with depositional areas along bends. Along the right bank downstream of the Route 171 bridge, several groundwater seeps were observed.

Vegetative communities and areas where ecological receptors may potentially be exposed within the study area are limited due to development. Where intact, vegetative communities consist mostly of riparian forest found along the Rio Arroyata and drainage ditches. The lateral extent of riparian habitats varies; however, all are minimal, continuing in most cases approximately 30 to 50 feet and abruptly ending due to encroaching development and roads.

In general, vegetative communities and available habitats are indicative of disturbed conditions as evidenced by former dilapidated structures and foundations, miscellaneous refuse, surrounding development, and the presence of non-native species such as African tulip tree (*Spathodea campanulata*), grapefruit (*Citrus ×paradisi*), black mimosa (*Mimosa pigra*), and dense stands of bamboo (*Bambusa* spp.); however, native tree species such as American muskwood (*Guarea guidonia*) are

present. Tree canopy cover ranges from 85 to 100 percent within the immediate stream corridor of the Rio Arroyata and drainage swales. With the exception of areas characterized by monotypical stands of bamboo, understory is dense and consists of various woody and herbaceous vegetative species. These species include buzzy lizzy (*Impatiens walleriana*), umbrella plant (*Cyperus involucratus*), arrowhead vine (*Syngonium auritum*), elephant ear (*Colocasia* spp.), flamingo flower (*Anthurium* spp.), and several species of philodendron (*Philodendrin* spp.). Other than physical disturbances, no impacts that may potentially be related to site contamination were present.

Various wildlife was observed during the ecological reconnaissance. Bird species included bananaquit (*Coereba flaveola*), rock dove (*Columba livia*), zenaida dove (*Zenaida aurita*), domestic chicken (*Gallus gallus domesticus*), and various unidentified song birds. Several large terrestrial snails (Order Gastropoda) were noted clinging to vegetation. Herpetofauna observed included species of lizards commonly known as anoles (Family Polychrotidae) and coqui frog (*Eleutherodactylus* spp.). Finally, several small fish which appeared to be guppy (*Poecilia reticulata*) were noted within the Rio Arroyata; however, this was not verified as none were captured for positive identification.

Threatened, Endangered Species/Sensitive Environments

Information regarding threatened and endangered species and ecologically sensitive environments that may exist at or in the vicinity of the site was requested from the EPA and PRDNER. Letters received from both agencies are presented in Attachment A.

The EPA reported that a review of United States Fish and Wildlife Service (USFWS) records indicate that two federally-listed species, the Puerto Rico boa (*Boa puertorriquena*) and the Puerto Rican Plain pigeon (*Paloma sabanera*), may be found within the municipality of Cidra. Neither species was encountered during the site visit.

The PRDNER reported that a review of their records for the site and surrounding area indicated no known occurrences of listed rare, threatened, and/or endangered species.

Conceptual Site Model

The CSM depicts the fate and transport of chemicals from source(s) to exposure media (surface water and sediment) and illustrates the exposure routes for ecological receptors. Development of the CSM includes identification of the sources of contamination, and potential exposure pathways (Figure 2). Due to almost a complete lack of viable habitats within upland portions of the site, and that most of the soil contamination is found in deeper soils of source areas no exposure pathways to ecological receptors utilizing the terrestrial environment is expected. In addition, source areas are situated within commercial and industrialized properties of the study area the majority of which are developed, and/or paved. Thus, the only potential for any considerable exposure to site-related contaminants is groundwater discharge within aquatic and immediate riparian habitats, where intact, of the Rio Arroyata.

Sources of Contamination

The main source of contamination in the southern area of the site is at Ramallo/CCC property, specifically along the northeastern side of the facility, where PCE levels in soil were as high as 3,300,000

micrograms per kilogram (µg/kg). The highest levels of site-related contaminants in the northern area of the site were found at the IDC property. Tetrachloroethene levels in soils in the southeastern portion of the property were as high as 1,700,000 µg/kg, TCE as high as 39,000 µg/kg, cis-1,2-DCE as high as 29,000 J µg/kg, and vinyl chloride as high as 1,200 µg/kg (CDM Smith 2013). A "J" qualifier indicates that the detected concentration is estimated.

For the purposes of this SLERA, it is assumed that contamination originating from these sources may have, or continues, to migrate to surrounding areas, more specifically the Rio Arroyata, via groundwater flow discharge and to a much lesser extent erosion, and overland flow.

Exposure Pathways

An exposure pathway is the means by which contaminants are transported from a source to ecological receptors. For this SLERA, contaminated soils and groundwater represent the source of site-related contaminants resulting in the contamination of Rio Arroyata sediment and surface water. The potential exposure pathways are illustrated on the CSM (Figure 2).

In undeveloped portions of the site within the riparian corridor of the Rio Arroyata, habitats may support or be utilized by various ecological receptors such as invertebrates, fish, amphibians, reptiles, birds, and mammals. This was observed during the ecological reconnaissance of the site. Ecological receptors utilizing these areas may be exposed to contaminated media via direct contact or incidental ingestion. Exposure may also occur through food chain exposure via ingestion of prey that may have become contaminated through site-related exposure.

Assessment Endpoints

Assessment endpoints are explicit expressions of an environmental resource that is considered of value, operationally defined by an ecological entity and its attributes (EPA 1997). In SLERAs, assessment endpoints are usually considered to be any adverse effects from site contaminants to any ecological receptors at the site. It is not practical or possible to directly evaluate risks to all the individual components of the ecosystem on site, so assessment endpoints are used to focus on particular components that could be adversely affected by the chemicals associated with the site.

A review of the CSM provided information for the selection of the assessment endpoint used to evaluate risk to ecological receptors at the site. Within the study area, aquatic ecosystems are present and have been potentially contaminated. Within these systems a number of biotic communities inhabit and/or forage. Therefore, the assessment endpoint used in this SLERA focused on these groups collectively to address all receptors utilizing the Rio Arroyata. The assessment endpoint is as follow:

- Viability (survival, growth, and reproduction) of aquatic ecological receptors/communities

Risk Questions

Risk questions summarize important components of the problem formulation phase of the SLERA and are based on the assessment endpoint. Risk questions are directly related to the testable hypotheses that can be accepted or rejected using the results of the SLERA. Selected risk questions to be answered in this SLERA include:

- May ecological receptors be exposed to site-related chemicals present in sediment and surface water of the Rio Arroyata?
- Where present, are concentrations of site-related chemicals in Rio Arroyata sediment and surface water sufficient to cause adverse effects on the survival, growth, and /or reproduction of ecological receptors?

Measurement Endpoints

Measurement endpoints are chosen to link the existing site conditions to the goals established by the assessment endpoint and are useful for assessment endpoint evaluation. Measurement endpoints are quantitative expressions of measured biological responses to contamination relevant to the selected assessment endpoint. A common type of measurement endpoint, at the SLERA stage, and used in this SLERA, is the comparison of site media chemistry results to ecological screening levels (ESLs).

The following measurement endpoint and associated assessment endpoint was selected to evaluate whether site-related chemicals pose a risk to ecological receptors:

- Assessment Endpoint :Viability (survival, growth, and reproduction) of aquatic ecological receptors/communities

Measurement Endpoint: Evaluate the toxicity of chemicals in sediment and surface water by comparing maximum-detected concentrations to sediment- and surface water-specific ESLs.

Data Used in the Screening Level Ecological Risk Assessment

Field investigations in support of the RI were conducted in three stages, Stage 1, Stage 2, and Stage 2a, to identify possible sources of contamination at the site. CDM Smith conducted the Stage 1 field investigation in July 2007 through January 2009, Stage 2 field investigation in April to July 2010, and Stage 2a investigation in April to June 2012. Soil, groundwater, surface water, and sediment samples were collected as part of the investigations. As noted above, only sediment and surface water are evaluated in this SLERA, as these are the only site media for which an exposure pathway to ecological receptors exists.

Surface Water and Sediment Sampling

CDM Smith collected ten co-located surface water and sediment samples during Stage 2a to determine if contaminants have migrated through the groundwater to surface water and sediments of the Rio Arroyata, located downgradient of the site. Samples were strategically located in areas where groundwater was expected to discharge into the river (Figure 3). One surface water sample (SW-1) and one sediment sample (SD-1) were collected upstream of the site to represent background conditions. Surface water samples were analyzed for Target Compound List (TCL) VOCs and Target Analyte List (TAL) inorganics; samples were also analyzed for general wet chemistry and natural attenuation parameters. Sediment samples were analyzed for TCL VOCs, TAL inorganics, grain size, pH, and total organic carbon. A more detailed discussion on the parameters analyzed and results is provided in the RI report.

Minimum and maximum concentrations of chemicals detected in sediment and surface water, their frequency of detection, location of maximum detected values, corresponding background concentrations, and a comparison to ESLs are presented in Tables 1 and 2, respectively.

Sediment: Tetrachloroethene was detected in one sediment sample (SD-9) at an estimated concentration of 1.9 J µg/kg. No other VOCs were detected. Several metals were also detected.

Surface Water: The site-related VOCs, PCE, TCE, and cis-1,2-DCE were detected in surface water samples at maximum concentrations of 4.6 micrograms per liter (µg/L), 0.25 J µg/L, and 0.65 µg/L, respectively. Maximum concentrations detected were all found in the sample collected from location SW-7. The VOCs, 2-hexanone, toluene, and 1,1,2-trichloroethane were also detected along with several metals.

Background: No site-related VOCs were detected in sediment or surface water background samples. Several metals were detected in both sediment and surface water background samples that were also detected in samples collected from the site (Tables 1 and 2).

Effects Data

This section presents the types and sources of effects data that serve as conservative effects concentrations for the SLERA. Effects data were limited to ESLs from the following references, and were applied in a hierarchical fashion to maximum chemical concentrations detected in sediment and surface water.

Sediment

- Ontario Ministry of the Environment Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (Persaud et al. 1993)
- EPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Sediment Screening Benchmarks (2006)

Surface Water

- Puerto Rico Water Quality Standards Regulation, Aquatic Life Values (2010)
- EPA National Recommended Water Quality Criteria (2012)
- EPA Region 3 BTAG Freshwater Screening Benchmarks (2006)

In this SLERA, the first set of benchmarks noted above for each medium were examined first to determine if a screening value was available for a particular chemical. If a value was available, it was utilized. If not, values from secondary sources were used in the order they are listed above. If a selected ESL was exceeded, or no ESL was located, chemicals were retained as chemicals of potential concern (COPCs).

Risk Characterization

In the risk characterization, risk to representative ecological receptors is estimated. This SLERA relies on the hazard quotient (HQ) approach. This process involves comparing chemical concentrations measured

in site media to their respective ESLs. By nature these values are conservative, and in this way avoid the potential for underestimating risk. For this SLERA, the maximum exposure concentration for a specific chemical is compared to its respective ESL counterpart. If resultant HQs are greater than unity (1.0), risk is implied. The HQ method is expressed as a ratio per the following formula:

$$\textit{Hazard Quotient} = \frac{\textit{Maximum Detected Concentration of a Chemical}}{\textit{ESL}}$$

Identification of Chemicals of Potential Concern

Chemicals with maximum detected concentrations above their respective ESLs are identified as COPCs, as are detected chemicals for which ESLs could not be identified, unless otherwise noted. No benchmarks are available for calcium, magnesium, potassium, and sodium. However, these elements are not considered in the evaluation of risk because they are ubiquitous, occur naturally in high concentrations, are essential nutrients, and are unlikely to pose risk. In addition, tissue concentrations of these elements are regulated by living organisms; even at relatively high levels of exposure, internal concentrations generally do not become sufficiently high to cause toxic effects. Chemicals identified as COPCs, and the rationale for their selection, are presented below:

Chemicals detected with maximum concentrations exceeding ESLs (HQs >1.0):

Sediment (Table 1)-chromium, copper, cyanide, iron, manganese, mercury, and nickel

Surface Water (Table 2) – aluminum, barium, lead, and manganese

Chemicals detected with no corresponding ESLs

Sediment (Table 1) – aluminum, barium, vanadium

Risk Summary

The following risk questions were identified as important to the SLERA. The results of the SLERA are used to respond to these questions and to help form conclusions. The risk questions and associated responses are presented below.

- *May ecological receptors be exposed to site-related chemicals present in sediment and surface water of the Rio Arroyata?*

  Response: Yes. The site-related chemical PCE was detected in one sediment sample. In addition, cis-1,2-DCE, PCE, and TCE were detected in surface water samples taken from the Rio Arroyata.

- *Where present, are concentrations of site-related chemicals in Rio Arroyata sediment and surface water sufficient to cause adverse effects on the survival, growth, and /or reproduction of ecological receptors?*

  Response: No. Concentrations of site-related chemicals detected in sediment and surface water were orders of magnitude below their respective ESLs. However, maximum concentrations of several metals detected in both media were above ESLs. In general, concentrations of those same

metals in background samples were either higher than, or similar to the maximum concentrations of metals detected in site sediment and surface water (Tables 1 and 2).

Uncertainties

In SLERAs, conservative assumptions are generally made in light of the uncertainty associated with the risk assessment process. This minimizes the possibility of concluding that no risk is present when a threat actually does exist (e.g., minimizes false negatives). However, the accuracy with which risk was predicted is not known. The use of conservative assumptions likely overestimates potential risk.

Potential risks due to chemicals in site media to ecological receptors at the site were evaluated by comparing maximum exposure concentrations to ESLs, an approach that provides the lowest level at which harmful effects would be predicted to occur. Use of maximum concentrations likely overestimated the average concentrations to which receptors may be exposed.

The CSM presents the pathways by which contaminants are released from source areas to expose receptors. However, some exposure pathways are difficult to evaluate or cannot be quantitatively evaluated based on available information. Within this SLERA only the direct contact pathway was evaluated. Use of such a conservative endpoint may result in overestimating potential risk.

For this SLERA, the evaluation optimizes exposure of receptors by assuming a significant portion of their life cycles is restricted to areas of contamination. Such an assumption may be conservative.

Concentrations used to represent exposure point concentrations and characterizations of the distributions of COPCs can be a source of uncertainty. These issues relate to the adequate characterization of the nature and extent of chemical contamination. It is assumed that sufficient samples have been collected from site media and appropriately analyzed to adequately describe the nature and extent of chemical contamination resulting from the release of site-related chemicals.

In this SLERA, it was assumed that COPCs detected in site media were 100 percent bioavailable. This is a conservative assumption that most often will overestimate risk.

Effects data can also contribute to overall uncertainty in the risk assessment. While all ESLs used in this SLERA are associated with some degree of uncertainty. It is assumed that the ESLs selected for use in this SLERA are generally similar to other ESLs, are commonly accepted for screening, and adequate for estimating risk using conservative assumptions.

Summary and Conclusions

Based on a comparison of maximum detected concentrations of contaminants in site sediment and surface water to conservatively derived ESLs, the potential for ecological risk may occur. Specifically, HQs > 1.0 were calculated, which indicate potential risk from exposure to the following media-specific contaminants.

Chemicals detected with maximum concentrations exceeding ESLs (HQs >1.0):

- Sediment -chromium, copper, cyanide, iron, manganese, mercury, and nickel

- Surface Water– aluminum, barium, lead, and manganese

Potential risk in sediment cannot be quantified as ESLs are not available for these metals:

- aluminum, barium, and vanadium

As noted above, only metals were found in exceedance of ESLs. In general, concentrations of the same metals in background samples were either higher than, or similar to the maximum concentrations of metals detected in site sediment and surface water. The concentrations of metals detected are most likely reflective of natural conditions, or non site-related sources.

The site-related chemical, PCE, was detected in one sediment sample, and cis-1,2-DCE, PCE, and TCE were detected in surface water samples taken from the Rio Arroyata; however, all concentrations were orders of magnitude below their respective ESLs. Therefore, the site poses no site-related risk to ecological receptors present.

References

CDM Federal Programs Corporation (CDM Smith). 2013. Draft Remedial Investigation Report, Cidra Groundwater Contamination Site. February.

United States Environmental Protection Agency (EPA). 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006. June.

EPA. 1998. Guidelines for Ecological Risk Assessment. EPA/630-R-95/002F. April.

EPA. 2006. EPA Region 3 BTAG Screening Benchmarks, Mid-Atlantic Risk Assessment: Ecological Risk Assessment. http://www.epa.gov/reg3hwmd/risk/eco/index.htm.

EPA. 2012. National Recommended Water Quality Criteria. Office of Water. Http://water.epa.gov/scitech/swguidance/standards/index.cfm.

Persaud D., R. Jaagumagi, and A. Hayton. 1993. Ontario Ministry of the Environment Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, ISBN 0-7778-9248-7. August.

Puerto Rico Water Quality Standards Regulation. 2010. Commonwealth of Puerto Rico Office of the Governor Environmental Quality Board. March.

Tables

Table 1
Comparison of Chemicals Detected in Sediment to Ecological Screening Levels
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

Chemical Name	CAS Number	Minimum Concentration Detected	Maximum Concentration Detected	Location of Maximum Concentration	Frequency of Detection	Screening Value	Hazard Quotient	COPC	Rationale	Background Concentration
Volatile Organic Compounds (µg/kg)										
Tetrachloroethene	127-18-4	1.9 J	1.9 J	SD-9	1 / 9	468 b	0.00406	No	BSL	ND
Inorganics (mg/kg)										
Aluminum	7429-90-5	10600 J	19900	SD-2	9 / 9	NL	NC	Yes	NV	20200
Arsenic	7440-38-2	3 J	4.7 J	SD-5	5 / 5	6 a	0.78	No	BSL	5 J
Barium	7440-39-3	61.8 J	61.8 J	SD-2	1 / 1	NL	NC	Yes	NV	80.4 J
Calcium	7440-70-2	6630 J	19300 J	SD-3	9 / 9	NL	NC	No	EN	13100
Chromium	7440-47-3	35.7	35.7	SD-2	1 / 1	26 a	1.4	Yes	ASL	43.7
Cobalt	7440-48-4	19.3	19.3	SD-2	1 / 1	50 b	0.39	No	BSL	35
Copper	7440-50-8	31.2 J	83.4 J	SD-2	9 / 9	16 a	5.2	Yes	ASL	52.6 J
Cyanide	57-12-5	0.62	0.62	SD-10	1 / 9	0.1 b	6.2	Yes	ASL	ND
Iron	7439-89-6	22200 J	38900 J	SD-2	9 / 9	20000 a	1.9	Yes	ASL	42300 J
Lead	7439-92-1	24.4 J	24.4 J	SD-5	1 / 1	31 a	0.79	No	BSL	R
Magnesium	7439-95-4	4590 J	8850 J	SD-10	9 / 9	NL	NC	No	EN	9820
Manganese	7439-96-5	729 J	1250 J	SD-8	9 / 9	460 a	2.7	Yes	ASL	2170
Mercury	7439-97-6	0.017 J	0.92	SD-6	2 / 9	0.2 a	4.6	Yes	ASL	0.022 J
Nickel	7440-02-0	26.5	26.5	SD-2	1 / 1	16 a	1.7	Yes	ASL	34.5
Potassium	7440-09-7	700 J	700 J	SD-8	1 / 9	NL	NC	No	EN	863
Vanadium	7440-62-2	83.3 J	149 J	SD-10	9 / 9	NL	NC	Yes	NV	234 J
Zinc	7440-66-6	36.6 J	116 J	SD-5	9 / 9	120 a	0.97	No	BSL	101 J

Notes:

µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
ASL - above screening level
BSL - below screening level
COPC - chemical of potential concern
EN - essential nutrient
J - estimated
NC - no hazard quotient calculated
ND - chemical not detected in background sample
NL - not listed
NV - chemical detected, but no screening value located
R - results rejected during data validation

a- Persaud, D., Jaagumagi, R., and Hayton, A. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. ISBN 0-7729-9248-7. Ontario Ministry of the Environment, Ottawa, Ontario. 23p.

b- United States Environmental Protection Agency, Region 3 Biological Technical Assistance Group. 2006. Freshwater Sediment Screening Benchmarks. August.

Table 2
Comparison of Chemicals Detected in Surface Water to Ecological Screening Levels
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

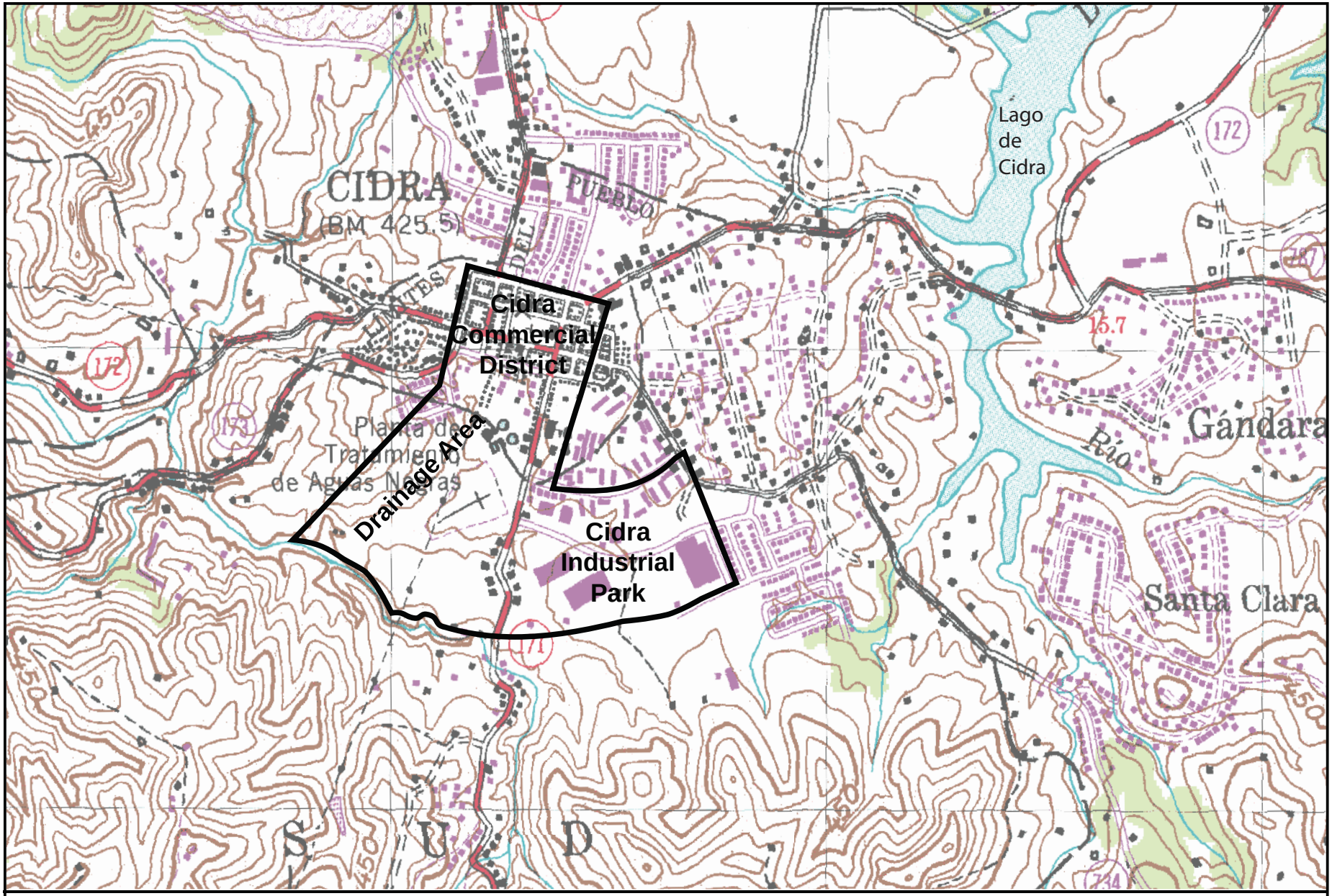
Chemical Name	CAS Number	Minimum Concentration Detected	Maximum Concentration Detected	Location of Maximum Concentration	Frequency of Detection	Screening Value	Hazard Quotient	COPC	Rationale	Background Concentration
Volatile Organic Compounds (µg/L)										
2-Hexanone	591-78-6	3.4 J	4.2 J	SW-6	3 / 9	99 c	0.04	No	BSL	ND
cis-1,2-Dichloroethene	156-59-2	0.27 J	0.65	SW-7	3 / 9	970 c**	0.001	No	BSL	ND
Tetrachloroethene	127-18-4	1.8	4.6	SW-7	5 / 5	111 c	0.04	No	BSL	ND
Toluene	108-88-3	0.18 J	0.18 J	SW-6	1 / 9	2 c	0.09	No	BSL	ND
Trichloroethene	79-01-6	0.25 J	0.25 J	SW-7	1 / 9	21 c	0.01	No	BSL	ND
1,1,2-Trichloroethane	79-00-5	0.062 J	0.062 J	SW-6	1 / 9	1200 c	0.0001	No	BSL	ND
Inorganics (µg/L)										
Aluminum	7429-90-5	27.6	99	SW-3	9 / 9	87 c	1.1	Yes	ASL	153
Antimony	7440-36-0	4.3	6.9 J	SW-5	5 / 5	30 c	0.23	No	BSL	3.7
Arsenic	7440-38-2	0.96 J	1.1	SW-8	9 / 9	150 b	0.007	No	BSL	0.88 J
Barium	7440-39-3	28.5	32.7	SW-6	9 / 9	4 c	8.2	Yes	ASL	29.9
Calcium	7440-70-2	38400	52000	SW-2	9 / 9	116000 c	0.45	No	BSL; EN	69700
Chromium	7440-47-3	0.3 J	0.41 J	SW-9	8 / 9	85 c	0.005	No	BSL	ND
Cobalt	7440-48-4	0.21 J	0.31 J	SW-4	9 / 9	23 c	0.01	No	BSL	0.4 J
Copper	7440-50-8	1.4 J	2.2	SW-4	9 / 9	17.6 a*	0.13	No	BSL	2.6 J
Cyanide	57-12-5	1 J	1 J	SW-4	1 / 8	5.2 a	0.19	No	BSL	ND
Iron	7439-89-6	60.5 J	60.5 J	SW-2	1 / 9	1000 b	0.06	No	BSL	191 J
Lead	7439-92-1	0.05 J	0.05 J	SW-2	1 / 9	0.039 a*	1.3	Yes	ASL	0.11 J
Magnesium	7439-95-4	17300	25700	SW-2	9 / 9	82000 c	0.31	No	BSL; EN	20500
Manganese	7439-96-5	13.7	205	SW-9	9 / 9	120 c	1.7	Yes	ASL	65.1
Nickel	7440-02-0	0.93 J	1.7	SW-4	9 / 9	97.8 a*	0.02	No	BSL	1.4
Potassium	7440-09-7	1950	2160	SW-6/SW-7	9 / 9	53000 c	0.04	No	BSL; EN	3110
Selenium	7782-49-2	0.28 J	0.28 J	SW-3	1 / 9	5 a	0.06	No	BSL	ND
Sodium	7440-23-5	26500	34600	SW-6	9 / 9	680000 c	0.05	No	BSL; EN	35400
Vanadium	7440-62-2	14.7 J	16.2 J	SW-9	9 / 9	20 c	0.81	No	BSL	8.8 J
Zinc	7440-66-6	2.3	2.8 J	SW-2	4 / 9	224.8 a*	0.01	No	BSL	8.9 J

Notes:

µg/L - micrograms per liter
ASL - above screening level
BSL - below screening level
COPC - chemical of potential concern
EN - essential nutrient
J - estimated
ND - chemical not detected in background sample

*- value adjusted using average hardness of 210 mg/L
**- value for trans-1,2-dichloroethene
a - Puerto Rico Water Quality Standards Regulation, Aquatic Life Values. 2010. Commonwealth of Puerto Rico March. Office of the Governor Environmental Quality Board.
b - United States Environmental Protection Agency (EPA). 2012. Office of Water. National Recommended Water Quality Criteria.
c - EPA, Region 3 Biological Technical Assistance Group. 2006. Freshwater Screening Benchmarks. August.

Figures



Source USGS 7.5 Minute Series Topographic Map, Comerio Quadrangle, Puerto Rico

Site Area

N

approximate scale

0 0.25 0.5 miles

Figure 1
Site Location Map
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

CDM Smith

R2-0006584

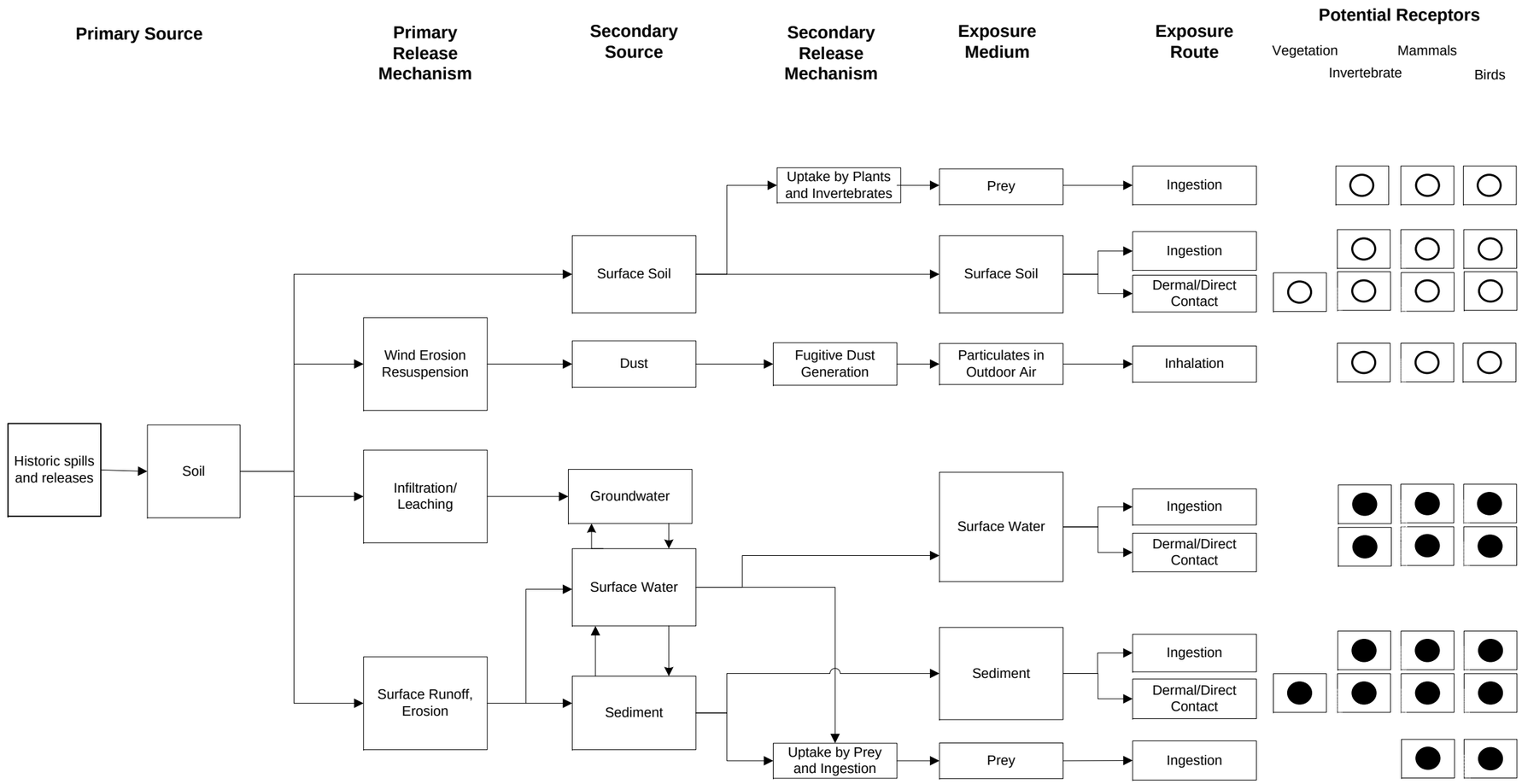
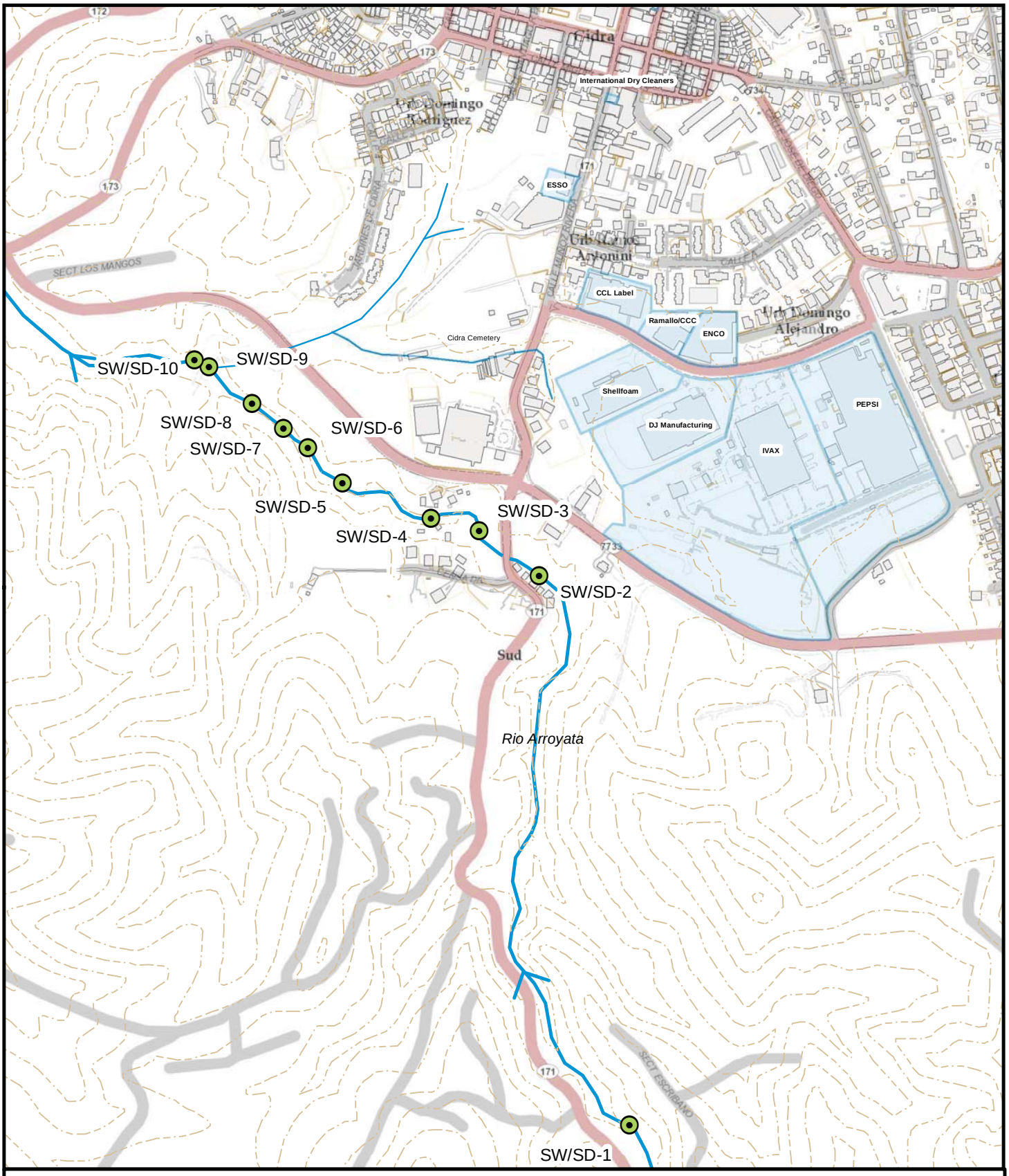


Figure 2
Conceptual Site Model
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

R2-0006585



Legend

- Properties investigated during the Remedial Investigation
- Stage 2a - Surface Water/Sediment Sampling Location (SW/SD)
- Unnamed drainage areas
- Rio Arroyata flow direction

0 112.5 225 450 675 900 Feet

Figure 3
Surface Water and Sediment Sample Locations
Cidra Groundwater Contamination Site
Cidra, Puerto Rico

CDM Smith

R2-0006586

Attachment A

Letters from the United States Environmental Protection Agency and Puerto Rico Department of Natural and Environmental Resources

CDM Smith

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUL 07 2011

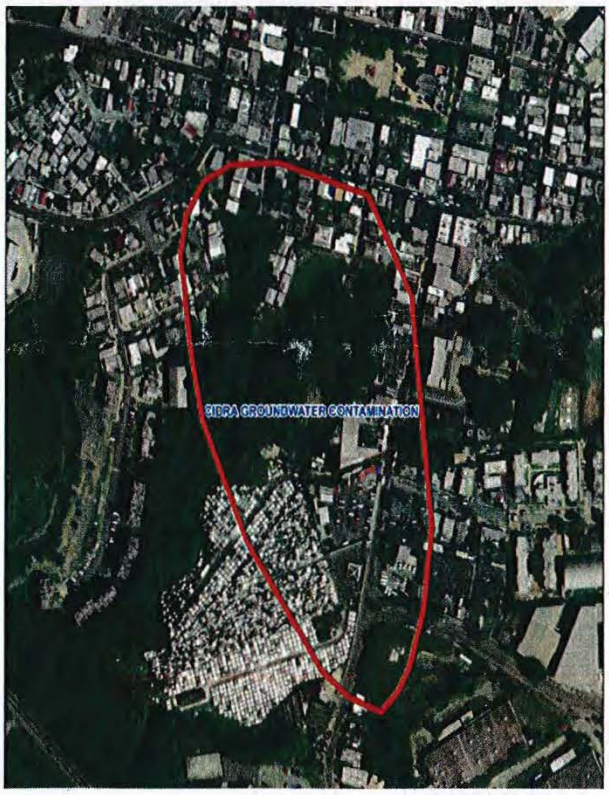
George G. Molnar
Environmental Scientist
CDM Federal
1110 Fieldcrest Avenue, 6th Floor
Edison, New Jersey 08837

Dear Mr. Molnar:

I have received your request for information concerning federally-listed endangered or threatened species or critical habitats located on or in the vicinity of the Cidra Groundwater Contamination Superfund site, located in Cidra, Puerto Rico. This information is needed in support of a screening level ecological risk assessment that is currently underway for this project.

This site consists of a ground water plume with no identified source(s) of contamination, located in the southeastern part of the island (see Figure 1). Four wells in Cidra were closed due to levels of tetrachloroethylene (PCE); other VOCs found include trichloroethylene (TCE) and 1,1-dichloroethylene (1,1-DCE).

Figure 1



The Environmental Protection Agency (EPA) has reviewed information on the United States Fish & Wildlife Service (FWS) website to determine what, if any, impacts to federally-listed endangered or threatened species or critical habitats are possible as a result of remedial activities at this site. According to FWS's 2007 "Caribbean Endangered Species Map," two federally-listed endangered species can be found in Cidra municipio: the Puerto Rico boa (*Boa puertorriqueña*) and the Puerto Rican Plain pigeon *(Paloma sabanera)*.

The Puerto Rican boa, the largest snake inhabiting Puerto Rico, is found in a variety of habitats, and has some presence throughout most of the municipios within Puerto Rico (see Figure 2). However, no critical habitat has been designated for this species. During the remedial investigation phase of this project, the potential for the Puerto Rican boa and/or its preferred habitat to be impacted by site-related remedial activities should be evaluated. Towards that end, I have enclosed a copy of the 1986 "Puerto Rican Boa Recovery Plan." If site activities may impact the Puerto Rican boa, formal consultation with the FWS may be required.

The Puerto Rican plain pigeon is a typical pigeon that feeds on fruits and seeds. According to the "Caribbean Endangered Species Map," its range includes a number of municipios in Puerto Rico including Cidra (see Figure 3), where it nests in bamboo groves and hardwood canyons. According to Figure 5 of the "Puerto Rican Plain Pigeon Recovery Plan" (see enclosed), the Cidra Groundwater Contamination Superfund Site is located in an area of "less vital habitat" for this species. However, please be aware that areas deemed 'essential habitat" are located nearby. While no critical habitat has been designated for this species, the RI/FS should note whether the Puerto Rican Plain pigeon and/or its preferred habitat could be impacted by this project. If site activities may impact the Puerto Rican Plain pigeon, formal consultation with the FWS may be required.

Please note that should the scope of future investigations or cleanups associated with this site go beyond the approximate boundaries of Figure 1, or should additional species be listed or critical habitat be designated under the Endangered Species Act, a revised determination from this office will be needed. If you require additional information, please feel free to contact me at (212)-637-3759, or by email at ferreira.steve@epa.gov.

Sincerely,

Steven J. Ferreira
Environmental Scientist
Environmental Review Section

Enclosures

bcc: A. Bosque, CEPD-RRB (w/o enclosures)
C. Nace, ERDD-PSB-TST (w/o enclosures)
N. Wirth, DEPP-SPMMPB
S. Ferreira, DEPP-SPMMPB
G. Musumeci, DEPP-SPMMPB (w/o enclosures)
S. Lamster, DEPP-SPMMPB (w/o enclosures)

Figure 2: Range of the Puerto Rican Boa

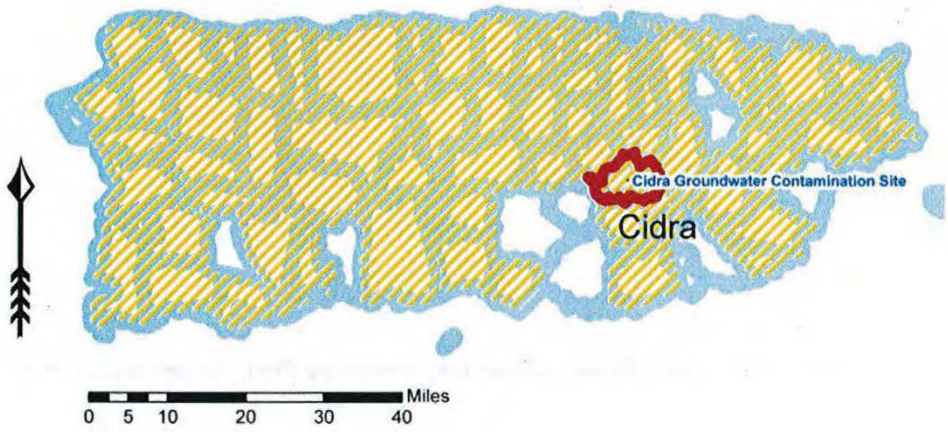
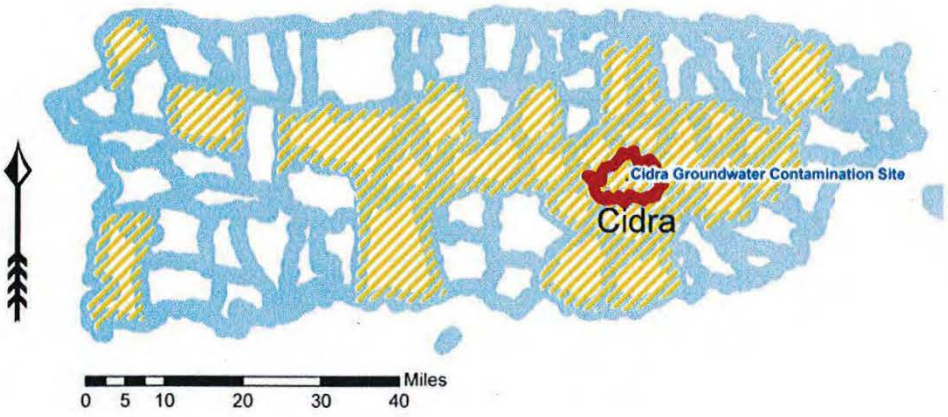


Figure 3: Range of the Puerto Rican Plain Pigeon



http://www.fws.gov/caribbean/es/PDF/Map.pdf

GOVERNMENT OF PUERTO RICO

Department of Natural and Environmental Resources

June 1, 2011

George C. Molnar
Environmental Scientist
CDM Federal Programs Corporation
110 Fieldcrest Avenue, 6th Floor
Edison, New Jersey 08837

Project: **EPA Region 2 RAC 2 Contract No.: EP-W-09-002**
Work Assignment: 004-RICO-02WE

DOC CONTROL NO.: **3320-004-00820**

Subject: **Information Request, Threatened and Endangered Species**
Cidra Groundwater Contamination Site
Remedial Investigation/Feasibility Study
Cidra, Puerto Rico

Dear Mr. Molnar:

This is a response to your request of information dated April 22, 2011 with respect to the above mentioned subject. The information hereby provided has been obtained based on available data at present in the Natural Heritage Division Data Bank concerning possible presence of Puerto Rico Department of Natural and Environmental Resources-listed rare, threatened, and/or endangered species at the site of concern in Cidra, Puerto Rico. The site is indicated on the enclosed United States Geological Survey topographic map.

No particular occurances of any inventoried critical element nor legally listed rare, threatened, and/or endangered species are recognized at the site as result of the search done.

Should you have any further questions, please contact Mr. Vicente Quevedo, Technical Advisor of our Comprehensive Planning Area at 787-999-2200, extension 2521.

Sincerely,

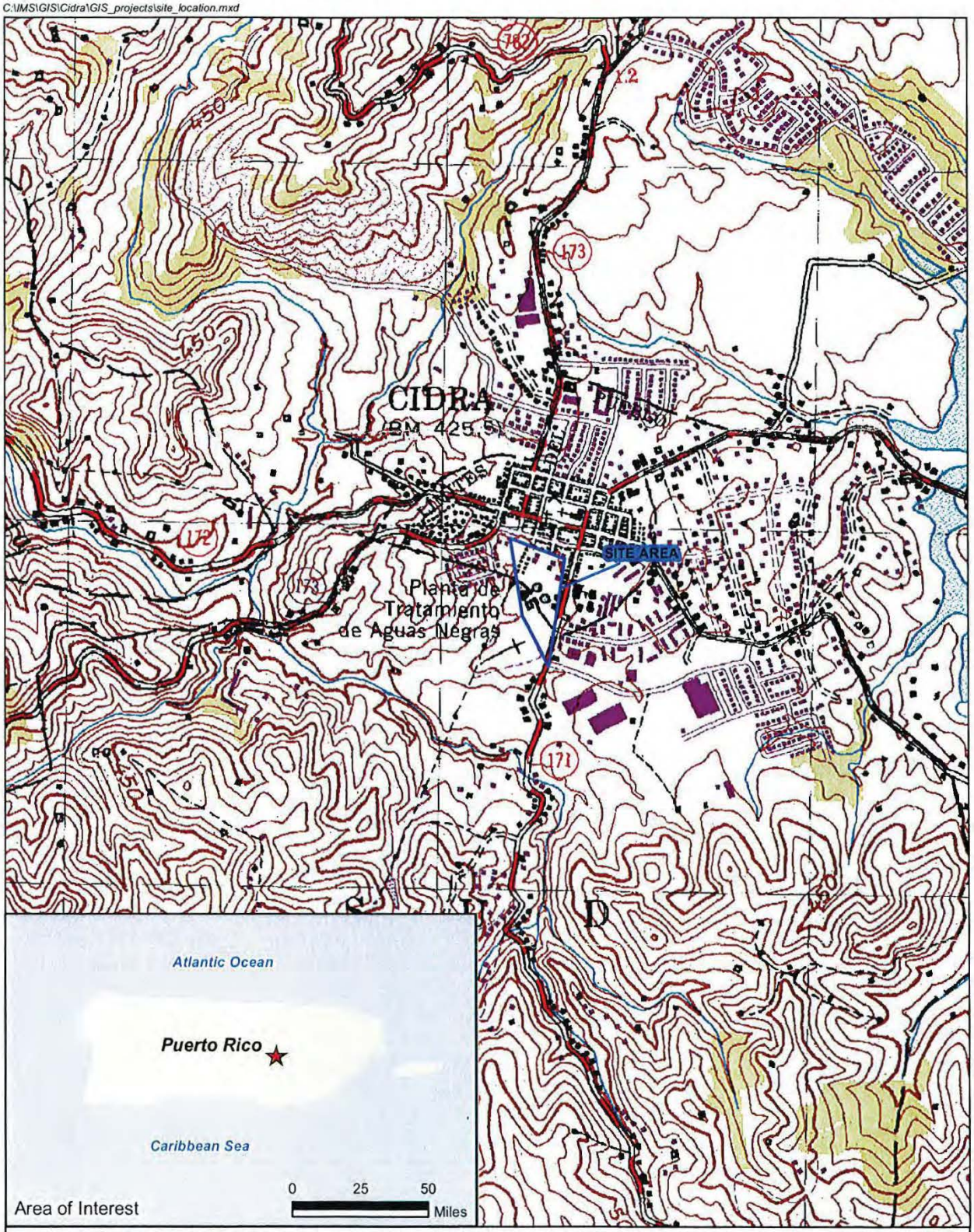
Héctor Rivera Santiago
Acting Assistant Secretary
Comprehensive Planning Area

enclosure

PUERTO RICO VERDE

PO Box 366147, San Juan, PR 00936
Tel. 787.999.2200 • Fax. 787.999.2203

C:\IMS\GIS\Cidra\GIS_projects\site_location.mxd



Source: USGS 7.5 Minute Series Topographic Quadrangle: Comerio, PR.

N

0 Feet 1,200

CDM

Site Location Map
Cidra Groundwater Plume Site
Cidra, Puerto Rico